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ABSTRACT

This document presents the scope and outline for an undergraduate course in mathematics education designed to teach methods of teaching secondary mathematics. After a course description and rationale, the essence of the course is divided into two parts: course objectives and a topical outline. The first part includes objectives in the areas of classroom management, mathematics pedagogy, mathematics education, media and technology, and assessment and evaluation. The topical outline organizes the material to accomplish these objective by topic. The component requirements for the course include: (1) laboratory experience; (2) field experience; (3) related research; (4) daily and weekly lesson plans; (5) laboratory reports; (6) unit or chapter plans; and (7) class presentations. A weekly schedule based on a 15-week semester is provided. (31 references) (MDH)

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S Y L L A B U S

METHODS OF TEACHING SECONDARY MATHEMATICS

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PEDAGOGY III

METHODS OF TEACHING SECONDARY MATHEMATICS

COURSE DESCRIPTION:

0833.451

The five credit course, junior-level is designed for students majoring in mathematics and planning a career as a secondary school mathematics teacher. It includes both campus and public school experience dealing with a wide variety of topics including mathematics education, strategies specific to teaching content, the psychologoy of teaching mathematics, short and long range planning, use of technology in the mathematics curriculum and enrichment topics to enhance the learning of mathematics.

RATIONALE:

The mathematics teaching methods course is a required course and a prerequisite for the professional semester of mathematics teaching. It is a course designed for students interested in a career as a secondary mathematics teacher. The course is comprised of two components, one campus based and the other taking place in the public school. The purpose of the course is to focus on the philosophical, psychological, and pedagogical premises within the realm of teaching mathematics. In addition, the course will provide the opportunity for the development of the instructional and evaluative techniques specific to teaching mathematics.

ESSENCE:

A) Objectives

I- Classroom Management

The student teacher will be able to demonstrate and express an understanding of the concept of providing a classroom environment conducive to learning mathematics.

The student teacher will be able to demonstrate knowledge of the techniques essential to maintaining a behavioral policy specific to mathematics activities.

II - Mathematics Pedagogy

With the knowledge of specific strategies, models, and approaches appropriate to the topic, the student teacher will be able:

To plan instruction which addresses the mathematical needs of all students in terms of their rate of learning .

To plan instruction which illustrates an awareness of the various learning styles of the student.

To plan instruction (short term or long term) utilizing a variety of strategies and innovative activities which will enhance student motivation and enjoyment.

To demonstrate mathematics instruction from a problem-solving approach which promotes discovery and exploration.

To plan instruction incorporating goal-specific questions which will induce analytical thinking, synthesis, and discussion.

To plan instruction incorporating a means of frequently monitoring student understanding of content during instruction.

To plan instruction incorporating a formal and concrete means of evaluating student performance and understanding of content.

To understand the concept of devising long term planning (weekly lessons and unit plans).

III - Mathematics Education

The student teacher will be able to express:

A personal philosophy of teaching mathematics based on research, field base experience and the practicuum.

Through a knowledge of the historical aspects of mathematics education, the universal impact of mathematics on society.

Through an application of researched topics, the benefits of an interactive and hands-on approach to teaching mathematics.

Through the coursework and research, an understanding of past mathematics projects and the impact on the current trends of mathematics.

Through the application of research, knowledge attained from the field experience, and the preparation and demonstration of instructional planning, the student teacher will be able:

To exhibit an accuracy of writing and articulation in speaking the mathematical language.

To organize instructional planning efficiently and effectively in terms of utilizing time and materials.

To evaluate and select mathematics textbooks based on the instructional objectives of the course and appropriate for student comprehension.

To evaluate and select software for instructional as well as student use.

To demonstrate an understanding of the impact of current trends and issues in mathematics education by participating in local, state, and national associations of mathematics.

To demonstrate an understanding of the essence of incorporating the relevance for learning mathematics through lesson preparation and presentation.

IV - Media and Technology

The student teacher will be able:

To incorporate the use of the computer as an instructional tool.

To incorporate the use of the computer as tutorial and/or as an instructional aid to students as drill and practice.

To incorporate in planning, the purpose and the use of the calculator.

To select and incorporate the use of supplementary and complementary material specific to topic and student.

To understand and be aware of the necessity to incorporate frequently the use of media and/or technology as a segment of instruction preparation.

V - Assessment and Evaluation

The student teacher will be able:

To construct a variety of evaluative instruments specific to topic and student ability.

To illustrate the relationship between instructional objectives and student achievement through the construction of a subjective test.

To demonstrate a questioning technique which assesses student comprehension

within a class period.

To devise a written instrument (subjective or objective) based on instructional objectives.

To interpret standardized tests in terms of student achievement and aptitude.

To be aware and understand the relationship between interpreting standardized tests and the impact on curriculum and student ability.

B) Topical Outline

I - Orientation to the Course
- a) Goals and objectives of the Course
- b) Structure/Relationship of Pedagogy and Mathematics
- c) Overview and expectations

II - Mathematics Education
- a) History
- b) Chronological presentation of math throughout the years in light of past projects and current trends
- c) Introduction to NCTM standards
- d) The Profession of Mathematics Teaching
- e) Introducing the use of Technology in teaching mathematics

III - Planning to teach mathematics
- a) textbook evaluation
- b) using audio-visual materials
- c) using supplementary materials
- d) reflecting content prior to writing the lesson plan
- e) knowing the academic composition of your student population
- f) preparing a daily lesson plan
- g) preparing weekly lesson plan
- h) Unit/Chapter plan
- i) using the computer and calculator

IV - Perceptions of students learning mathematics
- a) psychology of the way students learn mathematics
- b) psychology of teaching students to learn mathematics
- c) right and left hemispheres characteristics as related to learning math

V - Methods/Strategies/ Approaches of teaching mathematics
- a) selection of --- as related to:
  - student composition
  - content
  - performance objectives
- b) selection of strategies (motivational;innovative)

c) selection of approaches (spiral, discovery, problem -solving)
d) selection of appropriate supplementary and complementary materials
e) developing problem solving skills
f) developing relevance in learning as related to content
g) developing questions which induce analytical thinking
h) determining the appropriateness for using the computer and calculator
i) using the computer and calculator

VII - Student Assessment/Evaluation
a) developing a variety of evaluative instruments as related to content
b) developing and constructing a unit/chapter test
c) developing quizzes
d) interpreting test results (teacher constructed)
e) interpreting standardized tests in relation to content
f) developing criteria for projects, field trips, library usage, etc.

VIII - Curriculum
a) structure (principles of development)
b) decision making in developing curriculum
c) participating in curriculum development
d) implementing curriculum
e) incorporating and updating curriculum based on current societal demands
f) evaluation

IX - Issues
a) human relations (school personnel, parents, community)
b) cycle of teaching
c) preparing for the student teaching semester

Recommended class format:

: Discussion (field experience, current issues, curiosity)
: Issues in Mathematics Education
: Strategy in teaching (Algebra, Geometry, Advanced Mathematics)
: Content from topical outline
: Activity (student presentations, small group, AV presentations, etc.)
: Enrichment topics (topology, fractals, magic, etc.)

COMPONENT REQUIREMENTS

LABORATORY EXPERIENCE:

During the first six weeks of the course, in addition to the regularly scheduled class, students report to the computer laboratory on one day of the week (generally Friday) for a two hour session. The use of the calculator and the computer as instructional tools will be demonstrated. STudents will have the opportunity to review software, determine the appropriateness of use in content and to practice using technology with the guidance of the instructor.

FIELD EXPERIENCE:

The last eight weeks , students will be actively engaged in the following pedagogical aspects:

- observation of various instructional techniques
- observations of motivation techniques
- textbook evaluation
- prepare and present a lesson in the classroom
- through observation and/or interview, prepare an analytical assessment of teaching strategies
- participate in tutoring, grading tests and creating a content related bulletin board

RELATED RESEARCH

Rationale: A background in the knowledge of research-based literature in mathematics is essential to introducing and applying relevant criteria during the teaching of mathematics and as a means of understanding the learning of mathematics in preparing effective instruction.

Procedure: Topics for research are selected in relation to the content scheduled for each class. Students will have the opportunity to become familiar with mathematics educational periodicals and journals as well as increase their knowledge and enhance their mathematics background.

1. read at least 3 articles before making a selection for the report
2. read the article in the light of the author's viewpoint, justifications and outcomes
3. a written report will be required and will include a summary of the article, the author's viewpoint and the student's reaction supported by pedagogical facts.
4. to be discussed in class

DAILY LESSON PLAN; WEEKLY LESSON PLAN

Rationale: Preparation of instruction is the key ingredient to effective teaching and

affective learning. To become familiar with long-range planning, prospective teachers will be required to construct daily lesson plans with specific academic data provided.

The development of a daily lesson plan will be extended into the weekly lesson plan with emphasis on projecting time in coordination with content and student composition.

Procedure: A developmental approach is implemented in requiring the writing of lesson plans in that with each succeeding lesson plan, the emphasis on variation of strategies , development of key questions and use of technology/AV materials increases. The culmination is a fully developed lesson plan which incorporates an anticipatory set, relevance for learning, stating performance objectives and materials needed for the lesson, a procedural plan for implementing, and a formal means of evaluating student performance.

LABORATORY REPORTS (Software Review)

Rationale: The present status of universal needs invokes an individual to attain a background in technology. The NCTM standards suggest the application of using the computer and calculator in the various modes of teaching and learning mathematics. It is essential that the prospective teacher of mathematics be aware of the software available and an understanding of incorporating this concept into instruction.

Procedure: The students will complete two independent activities of evaluating software for purposes of implementing the use of the computer as an instructional tool. Students will select one topic each from Algebra and Geometry.

1) review software and select one item which has instructional characteristics
2) write a critique of each piece of software supporting your selection
3) write a lesson which will incorporate the software
    a) state performance objective
    b) appropriateness for content
    c) procedure for implement

UNIT PLAN/CHAPTER PLAN

Rationale: Preparation of the unit plan provides the prospective teacher with the opportunity to project and view content at long range and enables the teacher to grasp the idea of regulating time needed for the various topics of the unit. With a clear picture of what is to be taught within a particular time period, the teacher will be able to develop and to adjust preparation on a daily basis.

Procedure: The unit plan is to be developed over a four week period and submitted on the final day of the semester. The prospective teacher will apply previously learned course content and will develop a logical and adaptive unit plan. The unit plan is to complete in its submission, i.e., include all pertinent material such as quizzes, tests, copies of overhead transparencies, etc.

CLASS PRESENTATIONS

Rationale: In order to prepare students for student teaching, mini-presentations are implemented in the course on a progressive and developmental basis. The length of each presentation increases as students progress in writing lesson plans. In order to experience the theoretical with the practical, students present lesson plans which they have prepared. The lesson plans have been evaluated and therefore, the students have the opportunity to adapt suggestions and improve on their presentation. The emphasis is on mechanical factors (e.g., board use, speaking, etc.) as well as demonstrating and illustrating content.

Procedure: Prior to each presentation, a fully prepared lesson plan must be given to the college professor. Each presentation will have specific criteria for evaluation. The final mini-presentation will be take place in the classroom of the field based school and will be videotaped. The videotape will be a means of self-evaluation for the prospective student teacher.

WEEKLY SCHEDULE: (Classroom: 2 hours & 40 minutes; Laboratory : 2 hours & 40 minutes)

WEEK 1	Orientation of the course Computer Laboratory - Orientation
WEEK 2	Mathematics Education Computer Laboratory - Demonstration of software
WEEK 3	Planning to Teach (Part I); NCTM Standards Computer Laboratory - Demonstration of Calculator
WEEK 4	Planning to Teach (Part II) Computer Laboratory - Algebra content
WEEK 5	Perceptions of Learning Mathematics (Part I) Computer Laboratory - Geometry content
WEEK 6	Perceptions of Learning Mathematics (Part II) Computer Laboratory - Independent Activity
WEEK 7	Perceptions of Teaching Mathematics (Part I) Field Base Experience
WEEK 8	Mid - Term Evaluation
WEEK 9	Perceptions of Teaching Mathematics (Part II) Field Base Experience
WEEK 10	Methods, Strategies, Approaches (Part I) Field Base Experience
WEEK 11	Methods, Strategies, Approaches (Part II) Field Base Experience
WEEK 12	Student Assessment/Evaluation Field Base Experience
WEEK 13	Curriculum Field Base Experience
WEEK 14	Preparing to Student Teach Field Base Experience
WEEK 15	Final Evaluation

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